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VISUAL AIDS FOR AERIAL OBSERVERS ON FOREST INSECT SURVEYS[1/]

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Aerial surveys are widely used to detect, appraise, and map damage caused to forest trees by insects. The success of these surveys largely depends upon the ability of observers to distinguish differences in foliage color and tree condition. The observers' ability is influenced by several factors.

On aerial surveys, the rapidly changing scenery and the intense and prolonged searching of the forest for signs of insect damage, impose a great strain on the eyes of the observers. This strain is aggravated by haze, smoke, cloud shadows, and reflections on the windows of the airplane. About half the time, unfavorable angles of the sun's rays restrict visibility and contribute to the strain of observing. A further difficulty is that the observers must frequently and quickly refocus their eyes from long range observing in bright

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1/ The study on which this note is based was a cooperative undertaking by the Oregon State Board of Forestry, the Weyerhaeuser Timber Company, and the Pacific Northwest Experiment Station.

sunlight to close range viewing in the shadow of the airplane cabin to enter data on a map or aerial photograph.

Since 1947, when aerial surveys to detect forest insect outbreaks in Oregon and Washington were begun, various types and colors of viewing aids have been tried to relieve the strain on the eyes of observers and to improve the accuracy of their observations. Since 1952, special effort has been made to compare these aids and to adopt the ones best suited for surveys in this area. Plastic visors and colored glasses have been evaluated with assessment based upon the opinions of observers using them on actual surveys.

Plastic Visors

Heller and Aldrich[2/] used an amber-colored vinylite plastic observation mask on aerial surveys in the eastern United States and found it satisfactory. In Oregon and Washington, however, two types of plastic visors have been tried without success.

In 1952, three observers tested a visor consisting of an amber-colored plastic sheet attached to a light headband. The plastic sheet measured 8x10x0.20 inches and was strongly curved to fit over the entire face. This combination gave fair reduction of glare and fair penetration of haze. It accentuated the yellow and red color of dying and dead foliage as compared with green, but made all colors appear lighter than normal. Maps in the cabin of the airplane could be read through the visor without difficulty. After about 1/2-hour of use, however, eyestrain became excessive because of image distortion caused by curvature of the plastic sheet.

In 1955 and 1956, a dark smoke-colored plastic visor used on Air Force helmets was tested by four observers. The visors, consisting of 1/8-inch plastic moulded to fit the curvature of the face, were detached from the helmets and fitted to light-weight, adjustable headbands. Reduction of sunglare was excellent and haze penetration good. However, all colors were darkened to the point that light defoliation could be overlooked. Also, the filtering effect was too great to permit map reading in the shadow of the cabin. Eyestrain developed after about one hour of continuous use.

2/ Heller, R. C., and Aldrich, R. C. Observation masks for aerial spotting of insect damaged trees. U. S. Forest Serv. 2 pp. (Processed.) 1955.

Further testing of visors was abandoned because of two basic shortcomings of this type of aid: (1) Curvature of the plastic causes distortion of viewed objects and resultant eyestrain to observers, and (2) bulkiness makes viewing through windows difficult at some angles and also is troublesome in map reading because of the restricted space in the airplane.

Optical Glasses

During the 1955 and 1956 regional insect-damage surveys in Oregon and Washington, 11 types of glasses were rated under actual conditions by from 3 to 5 observers. Ratings were based upon effectiveness in reducing glare, penetrating haze, and accentuating the color of insect-damaged trees without seriously affecting mapping ability in the airplane cabin. The findings are summarized in table 1.

Prior to testing, it had been found that optically ground glasses were necessary to reduce eyestrain; hence, only optical glasses were used in the test. Outdoorsman-type, metallic frames with large curved lenses to cut out lateral light, also were found to be best. This combination of frames and lenses was used, except for the polarized glasses, which were not available in that style.

On the basis of the tests, four types of glasses are stocked for aerial observers on insect surveys in Oregon and Washington:

1. Smoky amber
2. Medium green with yellowish cast
3. Light yellow
4. Medium yellow

The first two listed are general-use glasses that are satisfactory under most conditions. Some observers prefer one, some the other, but the consensus favors the smoky amber type.

The yellow glasses are for special uses. They are particularly helpful in detecting light defoliations during periods of reduced visibility due to partial cloud cover, haze, or deep shadows. Some observers prefer the light yellow, others the medium yellow.

Experience has shown that optical glasses of the types listed above permit aerial observers to work efficiently 5 to 6 hours daily throughout the survey season without undue eyestrain.

Table 1.--Rating of tested optical glasses for use on forest insect surveys[1/]

Description of filter	Reduction of glare	Penetration of haze	Rendition of color	Map reading in shadow
Very light green with bluish cast (Calobar B)	Fair	Fair	Normal	No difficulty
Light green with bluish cast (Calobar C)	Good	Fair	Normal	Some difficulty
Medium green with yellowish cast (Ray Ban No. 3)	Excellent	Excellent	Normal	Some difficulty
Medium green with yellowish cast, upper part metallic coated[2/] (Ray Ban Single Gradient Density	Excellent	Good	Darkens all colors moderately	Too dark; quite difficult
Dark green with bluish cast (Calobar ED)	Excellent	Fair	Darkens all colors moderately	Too dark; quite difficult
Dark green with bluish cast, polarized[3/] (Calobar Polaroid)	Excellent	Fair	Darkens all colors considerably	Too dark; very difficult
Light yellow[4/] (Novial)	Fair	Good	Lightens all colors, accentuates yellows and reds	No difficulty
Medium yellow[4/] (Ray Ban Kalichrome C)	Fair	Good	Lightens all colors, accentuates yellows and reds	No difficulty
Smoky amber (rose smoke) (Cosmetan)	Excellent	Excellent	Accentuates yellows slightly, reds considerably	Some difficulty
Smoky amber (rose smoke), polarized[3/] (Cosmetan Polaroid)	Excellent	Excellent	Accentuates red and brown slightly, darkens other colors	Too dark; quite difficult
Neutral grey (Ray Ban G15)	Good	Poor; accentuates haze	Darkens all colors moderately	Too dark; quite difficult

1/ Brand names are supplied only for purposes of information in order to report factually on available data. The Forest Service and the Oregon State Board of Forestry neither guarantee nor warrant the standard of the product, and use of the brand name does not imply approval of the product to the exclusion of others that also may be suitable.

2/ Metallic coating very effective in reducing glare but sometimes blocks upward view.

3/ Available polarized lenses are small and let in glare from side. Darkening effect excessive for detecting light defoliation.

4/ Brightens entire landscape--an advantage in poor light but a disadvantage in bright sunshine. Imparts confusing whitish appearance to yellows and light greens.